VALID UNTIL 5/4/07

APPENDIX 6 – LARGE SPARK-IGNITION (LSI) OFF-ROAD EQUIPMENT

Below is additional information pertaining to the Large Spark-Ignition Off-Road Equipment category under AQMD's FY 2007 Carl Moyer Program (CMP). All information in Program Announcement (PA) PA #2007-08 and this Appendix apply. For additional detail regarding this program category, refer to CARB's 2005 CMP Guidelines. In the case of any conflict between CARB guidelines and AQMD criteria, the more stringent criteria will prevail.

In May 2006, CARB adopted a new regulation on New Emission Standards, Fleet Requirements, and Test Procedures for Forklifts and Other Industrial Equipment. The regulation requires fleets of more than three to meet a fleet average. Applicants must demonstrate that they are in compliance with any applicable regulations and that emission reductions funded by the Moyer Program are in fact surplus. CARB staff will provide specific criteria for the LSI Off-Road Category through a technical advisory approved by the Executive Officer, In the meantime, the 2003 CMP Guidelines and case-by-case approval will be used to evaluate LSI Off-Road projects.

In addition, CARB staff has issued a CMP Advisory (#06-003) revising the emission factors for Medium Heavy-Duty and Large Spark Ignited Equipment. This Advisory may be found at http://www.arb.ca.gov/msprog/moyer/advisories_005/advisories_005.htm. Special data submittal requirements apply and are indicated in Attachment 6 of the Application Forms. It is the Applicant's responsibility to check with AQMD's CMP web page for program clarifications, changes and updates. This page may be accessed by clicking the link on AQMD's home page at http://www.aqmd.gov/tao/implementation/carl_moyer_program_2001.html.

CARB MOYER PROGRAM RESOURCES

Applicants are highly encouraged to review CARB guidelines for additional requirements of the CMP. CARB guidelines are incorporated into AQMD's Moyer Program by reference. 2005 CARB guidelines may be downloaded from:

http://www.arb.ca.gov/msprog/moyer/guidelines/revisions05.htm

On this web page, there are links to the four parts of the CARB 2005 CMP guidelines. These parts are described below for easy reference.

- Part I provides the Executive Summary, Program Overview and Administrative Requirements primarily applicable to air districts) for CARB's Carl Moyer Program. The link to Part I is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part1.pdf

- Part II provides the Project Criteria for each program category. The link to Part II is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part2.pdf

- Part III provides the Agricultural Assistance Program guidelines. Link to Part III at http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part3.pdf

- Part IV is the Appendices section of the guidelines. The link to Part IV is http://www.arb.ca.gov/msprog/moyer/guidelines/2005_Carl_Moyer_Guidelines_Part4.pdf . This section includes the following Appendices.

    - Appendix A – Acronyms
    - Appendix B – Tables for Emission Reduction and Cost-Effectiveness Calculations
    - Appendix C – Cost-Effectiveness Calculation Methodology
    - Appendix D – Example Calculations
    - Appendix E – Description of Certification and Verification Executive Orders
    - Appendix F – Retrofit Emission Control Strategies
    - Appendix G – Description of Functional Equivalency of Non-Original Equipment Manufacturer Repowers and Rebuilt Engines for use in Repowers

HIGHLIGHTS FOR 2007

- The project cost-effectiveness limit is $14,300 per weighed ton of NOx, PM and ROG emissions reduced, except for electric forklifts with a lift capacity of 3,000 to 6,000 pounds. These forklifts have a cost-effectiveness limit of $7,000 per weighed ton of NOx, PM and ROG emissions reduced. The cost-effectiveness limit for forklifts with a lift capacity above 6,000 pounds is $14,300 per weighted ton of reduced emissions. A four (4) percent capital recovery factor is used for the cost-effectiveness calculation.

- Cost-effectiveness calculations are based on particulate matter (PM10), oxides of nitrogen (NOx), and reactive organic gases (ROG). The formula is provided below. AQMD staff will calculate the NOx, PM and ROG emissions reductions during the evaluation process.

Annualized Cost ($/year)

NOx reductions + 20(combustion PM10 reductions) + ROG reductions (tons/year)

- Applicants **must** provide current vendor quotes, **obtained within the last 90 days**, with their application to document the incremental cost of implementing the proposed technology. This will require documentation of both the baseline and low-emission project costs. Applicants can request funding up to the full differential cost between an optionally certified low-emission vehicle/engine/equipment and its new base standard emission equivalent; however, less may actually be awarded, depending on the results of the cost-effectiveness evaluation.

- Applicants **must** also provide documentation covering the past two years that justifies the activity level projected for the vehicles (i.e., mileage logs, hour-meter records, business records, fuel receipts, etc.).

- All projects must be operational within eighteen (18) months of contract execution or by May 31, 2009, whichever is earlier.

- The new engine/equipment/vehicle must not have been purchased prior to the effective date of the contract.

- AQMD reserves the right to disqualify any application that does not comply with all applicable requirements including submission of a complete application package. For On-Road Equipment projects, this includes the main application as well as the information requested in Attachment 6 to the main application.

- Pre- and Post-Inspection of all vehicles/engines approved for funding is required, as well as verification of engine destruction. Payment will be made only after all inspections are completed and engine/vehicle destruction is verified.

- As indicated earlier, diesel engine *retrofits* with CARB-verified systems are eligible for program funding. The AQMD Moyer Program will fund the cost of purchase and installation of a CARB-verified diesel emission control device, not exceeding the CMP cost-effectiveness limit. For retrofit projects that only take credit for NOx reductions from a Level 3 DECS (because the PM10 reductions are already required by regulation), the baseline cost is 1/2 the proposed project cost. The maximum funding for such projects would be the retrofit cost minus the default cost.

  In order to include NOx emission reductions in the cost-effectiveness evaluation, the technology must be verified to reduce NOx emissions by at least 15 percent compared to the original engine certification level.

- Leased forklifts are eligible for funding if the lease term is three years or more.

EVALUATION METHODOLOGY

AQMD staff will evaluate all submitted proposals and make recommendations to the Governing Board for final selection of project(s) to be funded. Proposals will be evaluated based on the cost-effectiveness of emissions (NOx + ROG + 20*PM) reduced on an equipment-by-equipment basis, as well as a project's "disproportionate impact" evaluation (discussed below). Be aware of the possibility that due to program priorities and/or funding limitations, project applicants may be offered only partial funding, and not all proposals that meet minimum cost-effectiveness criteria may be funded.

In compliance with AB 1390, Firebaugh, the FY 2006 CMP requires that at least 50 percent of the funds be spent in areas that are disproportionately impacted by air pollution. CARB has issued broad goals and left the details of how to implement this requirement to each air agency. In the South Coast Air Quality Management District, the disproportionately impacted areas are defined by a weighted formula that includes poverty level, particulate matter (PM) exposure and toxic exposure. The process is described below:

1. All projects must qualify for the CMP by meeting the cost-effectiveness limits established in the PA.

2. All projects will be evaluated according to the following criteria to qualify for Disproportionate Impact funding:

    a. Poverty Level: All projects in areas where at least 10 percent of the population falls below the Federal poverty level based on the year 2000 census data, will be eligible to be included in this category, and

    b. PM Exposure: All projects in areas with the highest 15 percent of PM concentration will be eligible to be ranked in this category. The highest 15 percent of PM concentration is 46 micrograms per cubic meter and above, on an annual average, or

    c. Toxic Exposure: All projects listed in the Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II) report[1] as having a cancer risk of 1,000 in a million and above will be eligible to be ranked in this category.

    Data for the poverty level and PM and toxic exposures were obtained from the U.S. Census, the 1998 AQMD monitoring data and Mates II study respectively.

[1] Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II), SCAQMD, March 2000.

3. Fifty percent of the funding available for this PA will be allocated among proposals located in disproportionately impacted areas. If the funding for disproportionately impacted areas is not exhausted with the outlined methodology, then staff will return to the Governing Board for direction. If funding requests exceed 50 percent of the total available funding, then all qualified projects will be ranked based on their disproportionate impact. Each project will be assigned a score that is comprised of 40 percent for poverty level, and 30 percent each for PM and toxic exposures. Proposals with the highest scores will receive funding until 50 percent of the total funding is allocated.

   All the proposals not awarded under the fifty percent disproportionate impact funding analysis will then be ranked according to cost-effectiveness, with the most cost-effective project funded first and then in descending order for each funding category until the remainder of the Moyer Funds are exhausted. Some projects that exceed the cost-effectiveness ceiling may receive partial funding, depending on their rankings.

ELIGIBLE COSTS

Eligible project costs (i.e., costs for which CMP funding is requested) are limited to the incremental cost of a project to implement the reduced emission technology. In the case of electric forklifts, one or more battery packs may be included in the application for funding. Operation and maintenance costs are not eligible for CMP funding, except for retrofit projects where filter cleaning is considered an eligible cost.. Please refer to the Project Types section below for additional detail.

PROJECT LIFE

A key parameter in the determination of a project's emission reduction benefit is its project life. The maximum project life forklifts under the 2003 Carl Moyer Program is 7 years. Project life for LSI off-road projects will be determined on a case-by-case basis in order to incorporate compliance with recent regulations

REPORTING AND MONITORING

All participants in the CMP are required to keep appropriate records during the full contract period. Project life is the number of years used to determine the cost-effectiveness and is equivalent to the contract life. All equipment must operate in the AQMD for this full project life. The AQMD shall conduct periodic reviews of each project's operating records to ensure that the engine is operated as stated in the program application. Annual records must contain, at a minimum:

- Total miles traveled
- Total miles traveled in the South Coast Air Basin
- Annual fuel consumed
- Annual maintenance and repair information

Records must be retained and updated throughout the project life and made available for AQMD inspection. The AQMD may conduct periodic reviews of each vehicle/equipment project's operating records to ensure that the vehicle is operated as required by the project requirements.

COST-EFFECTIVENESS EVALUATION DISCUSSION

Cost-effectiveness calculations are based on particulate matter (PM10), oxides of nitrogen (NOx), and reactive organic gases (ROG). AQMD staff will calculate the NOx, PM and ROG emissions reductions during the evaluation process. Please consult Carl Moyer Program Advisory: 06-003 for Medium Heavy-Duty and Large Spark Ignited Equipment. This Advisory may be found at http://www.arb.ca.gov/msprog/moyer/advisories_005/advisories_005.htm.
Only CMP funds are to be used in determining cost-effectiveness[2]. The one-time incentive grant amount is to be amortized over the project life (which is also the contract term) at a discount rate of 4 percent. The amortization formula (given below) yields a capital recovery factor (CRF), which, when multiplied by the initial capital cost, gives the annual cost of a project over its project term.

$$CRF = [(1 + i)^n (i)] / [(1 + i)^n - 1]$$

where

i = discount rate (4 percent)
n = project life (at least 3 years)

Table 6.1 lists the CRF for different project lives using a discount rate of 4 percent. Cost-effectiveness is determined by dividing the annualized costs of a project by the annual weighted emission reductions offered by the project.

[2] Unless the AQMD "buys down" the cost of the project by adding additional funding, in which case the total grant funding amount should be used for the cost-effectiveness calculation.

Table 6.1 – Capital Recovery Factors (CRF) for Various Project Lives At 4 Percent Discount Rate

Project Life	CRF
3	0.360
4	0.275
5	0.225
6	0.191
7	0.167
8	0.149
9	0.134
10	0.123
11	0.114
12	0.107
13	0.100
14	0.095
15	0.090
16	0.086
17	0.082
18	0.079
19	0.076
20	0.074

RECENT REGULATIONS

In anticipation of the recently adopted regulation, New Emission Standards, Fleet Requirements, and Test Procedures for Forklifts and Other Industrial Equipment, the LSI chapter was added to the CMP Guidelines replacing the Forklift Chapter in the 2003 Guidelines. This revision of the Guidelines expands funding opportunities from only forklifts to all LSI equipment types.

CARB staff will provide specific criteria to districts through a technical advisory approved by the Executive Officer. In the interim, districts may continue to use the 2003 Carl Moyer Program Guidelines to fund projects or request consideration of other projects on a case-by-case basis.

PROJECT CRITERIA

CARB encourages replacement of LSI equipment with zero-emission equipment where feasible. Information about zero-emission strategies is provided in Chapter 12 of the CARB Guidelines, Part II.

Sample calculations that illustrate the methodology for determining emission reductions and cost-effectiveness are included in Appendices C and D of Part IV of CARB's 2005 Guidelines. These may be downloaded from:
http://www.arb.ca.gov/msprog/moyer/moyer.htm

A. General

- Emission reductions obtained through Carl Moyer Program projects must not be

required by any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legal mandate.

- The project cost-effectiveness limit is $14,300 per weighed ton of NOx, PM and ROG emissions reduced (NOx + ROG + (20*PM10)), calculated in accordance with CARB's cost-effectiveness methodology, with the exception of electric forklifts with a lift capacity of 3,000 to 6,000 pounds which have a cost-effectiveness limit is $7,000 per weighed ton of NOx, PM and ROG emissions reduced.
- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to offset any emission reduction obligation of any person or entity.
- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.
- Projects must have a minimum project life of three years. ARB may approve a shorter project life on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.
- The contract term must extend to the end of the project life.
- Funded projects must have at least 75 percent of the vehicle's annual miles traveled or gallons consumed within the South Coast Air Basin.
- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the AQMD suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.
- Maximum project life for LSI projects is 7 years: Applicants must provide documentation to justify a longer project life. The default project life does not consider upcoming regulatory requirements. A shorter project life may be assigned due to regulatory requirements.
- All aftermarket emission controls (retrofits) must be verified by ARB.

Below are brief descriptions of potential projects. Off-road projects fall into three categories: 1) new purchase of an emission certified engine, 2) repower with an emission certified engine, and 3) retrofit with ARB-verified technology.

A. New Purchase

New or expanding facilities purchasing LSI equipment with engines that are certified to 30 percent below the current standard may qualify for funding if the emission reductions are shown to go beyond any regulatory requirement. IfLSI regulations are adopted by CARB, applicants would need to demonstrate that their entire fleet complies with the regulation (ie., meets a proposed fleet average) and the emission reductions funded by the CMP are surplus to any regulatory requirements..

Since replacing an older electric forklift with a newer electric model would not reduce emissions, projects with "electric to electric" replacements are excluded. Purchase of new CNG LSI equipment may also be eligible if it is certified to meet optional low emission standards.

B. Repower

Repower refers to the replacement of an existing engine with a newer engine certified to lower emission standards. This is an alternative to rebuilding an existing engine to the original higher emitting specifications the existing engine. The replacement engine must include all the emission controls components that an engine certified to a standard would have as stated in the Executive Order. There be some limits to repowering of LSI equipment because installing a newer engine design into existing equipment may not always be feasible. The baseline emissions for these projects would be the emission rate of the existing engine. The baseline cost would be the cost to rebuild. Repower projects may qualify for funding if the emission reductions are shown to exceed any regulatory requirement or LSI regulations adopted by the Board. Repowers of certified engines must provide at least a 15 percent emission reduction from the baseline engine and repowers of uncontrolled engines must meet the current emission standard.

C. Retrofit

Retrofit refers to modifications or additions made to an engine and/or fuel system such that the specifications of the retrofitted engine are not the same as the original engine. Data has shown that existing LSI engines retrofitted with closed loop, catalyst-based emission systems could achieve emission reductions similar to those achieved from new engines designed with catalysts. Retrofits for LSI equipment will likely incorporate advanced automotive-inspired emission control technologies that dramatically reduce emissions while meeting operational requirements. (See Section 4, Appendix F of the 2005 CMP guidelines for more discussion on retrofits.) This technology has been in use for about 10 years on a variety of LSI equipment. A retrofit would usually be installed at the time of engine rebuild or a regularly scheduled maintenance. To qualify for Carl Moyer Program funding, the retrofit technology must be verified for sale in California. The ARB has an interim verification procedure which manufacturers use to verify their emission control systems for LSI equipment.

To be eligible to receive Carl Moyer Program funds, emission reductions must exceed any regulatory requirement or LSI regulations adopted by the Board. Retrofit projects that control PM must use the highest level cost-effective technology available for the equipment being retrofitted. .

Typically under the Carl Moyer Program, retrofit projects are allowed if they provide at least 15 percent reductions in emissions. However, under the proposed LSI regulations only retrofits that reduce emissions by 25 percent or more will be verified. Hence, only retrofits that reduce emissions on uncontrolled LSI engines by 25 percent would be eligible for Carl Moyer Program funding. Retrofit systems for installation on emission-certified engines must be verified to no more than 2.0 g/bhp-hr of NOx+HC.

The eligible cost would be the complete emission control system and installation costs.

It must be installed according to the criteria stated in the interim verification letter or Executive Order as applicable.

Since nearly half of the LSI equipment in California is forklifts, some information on forklift classes is presented below. The Industrial Truck Association (ITA) has defined seven classes of forklifts. These classes are defined by the type of engine, work environment (indoors, outdoors, narrow aisle, smooth or rough surfaces), operator positions (sit down or standing), and equipment characteristics (type of tire, maximum grade, etc.). Several classes are further divided by operating characteristics. Classifications are described in CARB's Table 6-3.

Table 6-3
Forklift Classes

Class	Lift Code	Engine Type	Type/Use
1	1	Electric	Counterbalanced rider, stand up
1	4		Three-wheel, sit down
1	5		Counterbalanced rider, sit down
1	6		Counterbalanced rider, sit down
2			Narrow aisle truck
3			Hand or hand/rider truck
4		Internal Combustion	Rider, sit down, generally suitable for indoor use on hard surfaces
5			Rider, sit down, typically used outdoors, on rough surfaces or steep inclines
6		Internal combustion and Electric	Ride on unit with the ability to tow at least 1,000 pounds; designed to tow cargo rather than lift it (e.g. an airport tug)
7		Internal combustion (primarily diesel)	Rough terrain forklift truck for outdoor use; almost exclusively powered by diesel engines

Class 1 forklifts (lift codes 5 and 6) can be used in many of the same work applications as the class 4 or 5 forklifts because they are similar in design and specification. Increasing the use of class 1 forklifts relative to class 4 and 5 forklifts would reduce NOx emissions of the fleets.

Class 6 trucks are ride-on vehicles designed to tow at least 1,000 pounds. Airport tugs are an example of a Class 6 truck. See Chapter 7 for a description of ground support equipment.

Class 7 consists of rough terrain forklifts for outdoor use. See Chapter 5 for project funding criteria for Class 7 forklifts which are usually powered by diesel engines.

COST-EFFECTIVENESS CALCULATIONS

To receive Carl Moyer Program funding, each project must meet the maximum cost effectiveness threshold of $14,300 per weighted ton of covered pollutants The project cost-effectiveness limit is $14,300 per weighed ton of emissions reduced with the exception of electric forklifts with a lift capacity of 3,000 to 6,000 pounds which have a cost-effectiveness limit is $7,000 per weighed ton of NOx, PM and ROG emissions reduced.

The emission factors in the tables of CARB CMP Guidelines, Part IV, Appendix B are corrected in Carl Moyer Program Advisory: 06-003 for Medium Heavy-Duty and Large Spark Ignited Equipment. The corrected emission factors will be used for cost-effectiveness calculations. The CMP advisories may be accessed at http://www.arb.ca.gov/msprog/moyer/advisories_005/advisories_005.htm

Special Calculation Notes

For new electric forklift purchases, the baseline engine for the cost-effectiveness calculation is a new LSI forklift that meets the current emissions standard. Use Revised Tables B-14a, B-14b, B14c and B14d in CARB CMP Guidelines, Part IV, Appendix B and CMP 06-003 for Medium Heavy-Duty and Large Spark Ignited Equipment.6